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Inventor(s): YANG

Serial No.: 09/805,273

Group Art Unit: 2823

Filed: 03/13/2001

Examiner: ESTRADA, M.

Confirmation No: 1234

Title: A METHOD OF FORMING HIGHLY CONDUCTIVE SEMICONDUCTOR STRUCTURES VIA PLASMA ETCH

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RESPONSE TO NOTICE OF NON-COMPLIANT AMENDMENT

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In response to the Notice of Non-Compliant Amendment mailed from the USPTO on 09/07/06,

please find enclosed:

☒ Amendment and Response to Notice of Non-Compliant Amendment and Office Action,
12 pages total.

☐ Copy of Notice to be returned with response

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Please direct all correspondence concerning the above-identified application to the following address:

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Respectfully submitted,

Date: October 10, 2006

By:
William A. Zarbis
Reg. No. 46,120



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appellant:	Yang, W.	Patent Application
Application No.:	09/805,273	Art Unit: 2823
Filing Date:	March 13, 2001	Examiner: Estrada, M.
For:	A METHOD OF FORMING HIGHLY CONDUCTIVE SEMICONDUCTOR STRUCTURES VIA PLASMA ETCH	

APPEAL BRIEF

(Revised in response to Notification of Non-Compliant

Appeal Brief mailed September 7, 2006)

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1. Real Party in Interest

The real party in interest is Spansion LLC. The current assignee is Advanced Micro Devices, Inc.

2. Related Appeals and Interferences

There are no related appeals or interferences known to the Appellant.

3. Status of Claims

Claims 1-26, 36, 39 and 44-55 have been canceled. Claims 27-34 have been withdrawn. Claims 35, 37-38 and 40-43 have been rejected under 35 U.S.C. 103(a). This appeal involves Claims 35, 37-38 and 40-43.

4. Status of Amendments

An amendment has not been filed subsequent to the final rejection.

5. Summary of Claimed Subject Matter

Independent Claim 35 pertains to a process for making a semiconductor structure (please see Figure 4) that has a lower electrical resistance and a shorter vertical profile than conventional structures (page 3, line 22, through page 4, line 2). With reference to Figures 3 and 4, a conductive adhesive layer 104 comprising polysilicon is deposited on a substrate 103 comprising silicon-oxide/silicon nitride/silicon oxide (ONO), and a conductive layer 105 is deposited over the conductive adhesive layer 104 (page 6, lines 15-29, and page 7, lines 12-13). The conductive adhesive layer 104 has a minimum thickness required to provide adhesion between the substrate 103 and the conductive layer 105 for a robust structure that can withstand subsequent processing (page 7, lines 4-9).

In particular, the conductive adhesive layer 104 has a thickness that is greater than 10 Angstroms and less than 100 Angstroms (page 4, lines 21-23). A portion of the conductive layer 105 and the conductive adhesive layer 104 are etched using a plasma etchant (page 8, lines 22-23). The etchant includes chlorine and oxygen (page 11, lines 12-13). The plasma is ionized by a first RF source and accelerated by a second RF source (page 9, lines 10-12). The etching is conducted at a pressure between 2 mTorr and 4 mTorr (page 10, lines 19-20).

According to Claim 37, the conductive layer 105 and conductive adhesive layer 104 have a combined thickness of less than or equal to approximately 300 Angstroms (page 8, lines 12-14).

According to Claim 38, the conductive layer 105 includes a material such as tungsten or tungsten silicide (page 7, lines 13-15).

According to Claim 40, the chlorine flow rate is approximately 40 sccm to 100 sccm (page 11, lines 15-16).

According to Claim 41, the oxygen flow rate is approximately 4 sccm to 12 sccm (page 11, lines 16-17).

According to Claim 42, the first RF source power is approximately 800 watts to 1500 watts (page 12, lines 1-2).

According to Claim 43, the second RF source power is approximately 50 watts to 150 watts (page 12, lines 2-3).

6. Grounds of Rejection to be Reviewed on Appeal

Claims 35 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunikiyo (U.S. Patent No. 6,639,288) in view of Mui et al. ("Mui;" U.S. Patent No. 6,037,265) in further view of Applicant's Admitted Prior Art (AAPA).

Claims 37 and 40-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunikiyo in view of Mui in further view of AAPA in further view of Examiner's comments.

7. Arguments

Claims 35 and 38 versus Kunikiyo, Mui and AAPA

The following arguments are applicable to Claims 35 and 38, which are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunikiyo in view of Mui in further view of AAPA.

According to independent Claim 35, a "conductive adhesive layer has a minimum thickness required to provide adhesion between said substrate and said conductive layer for a robust structure that can withstand subsequent processing, wherein said conductive adhesive layer has a thickness that is greater than 10 and less than or equal to 100 angstroms," where the conductive adhesive layer comprises polysilicon and where the conductive adhesive layer is

disposed between a conductive layer and a substrate comprising ONO. Claim 38 is dependent on Claim 35 and recites additional limitations.

The final rejection of Claim 35 relies on Kunikiyo to teach the limitations cited above. The final rejection states that Kunikiyo discloses a conductive adhesive layer having a thickness of between 50 and 300 Angstroms, and thus Kunikiyo allegedly discloses the claimed range.

However, Appellant respectfully asserts that Kunikiyo does not show or suggest a conductive adhesive layer having a thickness of between 50 and 300 Angstroms. According to the final rejection, Kunikiyo's polysilicon side wall 5 is equated with the claimed conductive adhesive layer. Appellant can find no mention in Kunikiyo, either explicitly or implicitly, of a thickness of between 50 and 300 Angstroms for polysilicon side wall 5 or, for that matter, any other polysilicon structure disclosed by Kunikiyo. The final rejection does not cite where such a range can be found in Kunikiyo. Appellant respectfully requests that, if the rejection of independent Claim 35 and its dependent claims is to be maintained, then the portion of Kunikiyo that shows or suggests a thickness of between 50 and 300 Angstroms for a conductive adhesive layer comprising polysilicon, where the conductive adhesive layer comprises polysilicon and where the conductive adhesive layer is disposed between a conductive layer and a substrate comprising ONO, be identified.

A dimension of Kunikiyo's side wall 5 can possibly be deduced from Figure 2 of Kunikiyo, for example. In Figure 2, side wall 5 appears to be slightly thicker than the thickness of insulating film 3. According to Kunikiyo, insulating

film 3 has a thickness of about 100 nm, or 1000 Angstroms (please see column 10, lines 61-62, of Kunikiyo). Thus, side wall 5 would also appear to have a thickness of at least 1000 Angstroms, which is greater than the claimed range of 10 to 100 Angstroms.

In summary, Appellant respectfully submits that Kunikiyo does not show or suggest a “conductive adhesive layer [that] has a thickness that is greater than 10 and less than or equal to 100 angstroms.” By similar rationale, Appellant respectfully submits that Kunikiyo does not show or suggest a “conductive adhesive layer [that] has a minimum thickness required to provide adhesion between said substrate and said conductive layer for a robust structure that can withstand subsequent processing” also recited in independent Claim 35.

Appellant also respectfully submits that neither Mui nor AAPA, alone or in combination with Kunikiyo, shows or suggests these claimed limitations. Mui teaches a polysilicon layer 16 that ranges in thickness from 300 to 8000 Angstroms (please see column 6, lines 9-10, of Mui). AAPA discloses a conductive adhesive layer of 1000 Angstroms or more.

Thus, Appellant respectfully submits that Kunikiyo, Mui and AAPA, alone or in combination, do not show or suggest the limitations of independent Claim 35. Consequently, Appellant respectfully submits that the basis for rejecting Claim 35 under 35 U.S.C. § 103(a) is traversed and that Claim 35 is in condition for allowance. As such, Appellant respectfully submits that the basis for rejecting Claim 38 under 35 U.S.C. § 103(a) is also traversed as Claim 38 is dependent on an allowable base claim and recites additional limitations.

Claims 37 and 40-43 versus Kunikiyo, Mui, AAPA and Examiner's Comments

The following arguments are applicable to Claims 37 and 40-43, which are rejected under 35 U.S.C. 103(a) as being unpatentable over Kunikiyo in view of Mui in further view of AAPA in further view of Examiner's comments.

Claims 37 and 40-43 are dependent on independent Claim 35 and recite additional limitations. Hence, by demonstrating that Kunikiyo, Mui, AAPA and Examiner's comments do not show or suggest the limitations of Claim 35, it is also demonstrated that Kunikiyo, Mui, AAPA and Examiner's comments do not show or suggest the limitations of Claims 37 and 40-43.

According to Claim 35, a "conductive adhesive layer has a minimum thickness required to provide adhesion between said substrate and said conductive layer for a robust structure that can withstand subsequent processing, wherein said conductive adhesive layer has a thickness that is greater than 10 and less than or equal to 100 angstroms," where the conductive adhesive layer comprises polysilicon and where the conductive adhesive layer is disposed between a conductive layer and a substrate comprising ONO.

The final rejection of Claim 35 relies on Kunikiyo to teach the limitations cited above. The final rejection states that Kunikiyo discloses a conductive adhesive layer having a thickness of between 50 and 300 Angstroms, and thus Kunikiyo allegedly discloses the claimed range.

However, Appellant respectfully asserts that Kunikiyo does not show or suggest a conductive adhesive layer having a thickness of between 50 and 300 Angstroms. According to the final rejection, Kunikiyo's polysilicon side wall 5 is equated with the claimed conductive adhesive layer. Appellant can find no mention in Kunikiyo, either explicitly or implicitly, of a thickness of between 50 and 300 Angstroms for polysilicon side wall 5 or, for that matter, any other polysilicon structure disclosed by Kunikiyo. The final rejection does not cite where such a range can be found in Kunikiyo. Appellant respectfully requests that, if the rejection of independent Claim 35 and its dependent claims is to be maintained, then the portion of Kunikiyo that shows or suggests a thickness of between 50 and 300 Angstroms for a conductive adhesive layer comprising polysilicon, where the conductive adhesive layer comprises polysilicon and where the conductive adhesive layer is disposed between a conductive layer and a substrate comprising ONO, be identified.

A dimension of Kunikiyo's side wall 5 can possibly be deduced from Figure 2 of Kunikiyo, for example. In Figure 2, side wall 5 appears to be slightly thicker than the thickness of insulating film 3. According to Kunikiyo, insulating film 3 has a thickness of about 100 nm, or 1000 Angstroms (please see column 10, lines 61-62, of Kunikiyo). Thus, side wall 5 would also appear to have a thickness of at least 1000 Angstroms, which is greater than the claimed range of 10 to 100 Angstroms.

In summary, Appellant respectfully submits that Kunikiyo does not show or suggest a "conductive adhesive layer [that] has a thickness that is greater than 10 and less than or equal to 100 angstroms." By similar rationale, Appellant

respectfully submits that Kunikiyo does not show or suggest a “conductive adhesive layer [that] has a minimum thickness required to provide adhesion between said substrate and said conductive layer for a robust structure that can withstand subsequent processing” also recited in independent Claim 35.

Appellant also respectfully submits that neither Mui nor AAPA nor the Examiner’s comments, alone or in combination with Kunikiyo, shows or suggests these claimed limitations. Mui teaches a polysilicon layer 16 that ranges in thickness from 300 to 8000 Angstroms (please see column 6, lines 9-10, of Mui). AAPA discloses a conductive adhesive layer of 1000 Angstroms or more. The Examiner’s comments do not appear to address these limitations.

Thus, Appellant respectfully submits that Kunikiyo, Mui, AAPA and Examiner’s comments, alone or in combination, do not show or suggest the limitations of independent Claim 35. Consequently, Appellant respectfully submits that Claim 35 is in condition for allowance. As such, Appellant respectfully submits that the basis for rejecting Claims 37 and 40-43 under 35 U.S.C. § 103(a) is also traversed as these claims are dependent on an allowable base claim and recite additional limitations.

8. Conclusions

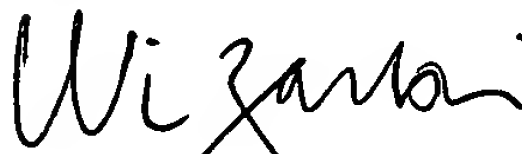
Appellant believes that Claims 35 and 38 are patentable over Kunikiyo in view of Mui in further view of AAPA, and that Claims 37 and 40-43 are patentable over Kunikiyo in view of Mui in further view of AAPA in further view of Examiner’s comments.

Appellant respectfully requests that the rejection of Claims 35, 37-38 and 40-43 be reversed.

Dated: 10/10, 2006

Respectfully submitted,

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Appendix I – Clean Copy of Claims on Appeal

1-26. (Canceled).

27-34. (Withdrawn).

35. (Previously Presented) A process for making a semiconductor structure comprising:

depositing a conductive layer upon a substrate comprising a silicon oxide-silicon nitride-silicon oxide (ONO) layer;

depositing a conductive adhesive layer comprising polysilicon between said substrate and said conductive layer, wherein said conductive adhesive layer has a minimum thickness required to provide adhesion between said substrate and said conductive layer for a robust structure that can withstand subsequent processing, wherein said conductive adhesive layer has a thickness that is greater than 10 and less than or equal to 100 angstroms; and

etching a portion of said conductive layer and a portion of said conductive adhesive layer utilizing a plasma without sacrificing said substrate, wherein said plasma comprises an etchant, wherein said etchant comprises chlorine and oxygen, wherein said plasma is ionized and sustained by a first RF source, and wherein said plasma is accelerated by a second RF source, wherein said etching is conducted at a pressure of between 2 mTorr and 4 mTorr, wherein a selectivity of said etching obviates a need for an adhesive layer of greater than 100 angstrom thickness, and wherein said process yields a semiconductor structure comprising a lower electrical resistance and a shorter vertical profile than a semiconductor structure comprising a conductive adhesive layer of greater than 100 angstrom thickness.

36. (Canceled).

37. (Previously Presented) The process of Claim 36, wherein said conductive layer and said conductive adhesive layer have a combined thickness of approximately 3000 angstroms or less.

38. (Previously Presented) The process of Claim 35, wherein said conductive layer comprises a material selected from the group consisting of tungsten and tungsten silicide.

39. (Canceled).

40. (Previously Presented) The process of Claim 35, wherein a flow rate of said chlorine is approximately 40 to 100 sccm.

41. (Previously Presented) The process of Claim 35, wherein a flow rate of said oxygen is approximately 4 to 12 sccm.

42. (Previously Presented) The process of Claim 35, wherein said first RF source is approximately 800 to 1500 watts.

43. (Previously Presented) The process of Claim 35, wherein said second RF source is approximately 50 to 150 watts.

44-55. (Canceled).

Appendix II – Evidence

There is no evidence entered and relied upon in this appeal.

Appendix III – Related Proceedings

There are no proceedings identified as related appeals and interferences.